Simple calculations regarding contribution of pathways

Suppose we have four pathways, each contributing p_1, p_2, p_3 and p_4 percent to the dose (or risk)

$$p_1 = 100 \cdot dose_1 / dose$$
$$p_2 = 100 \cdot dose_2 / dose$$
$$p_3, p_4, \text{etc}$$

Now suppose one of the pathway doses, say $dose_1$, is underestimated (overestimated) by some amount u_1. Then a new overall dose, and percent contributions can be calculated.

$$dose' = dose + u_1$$
$$p_1' = 100 \cdot (dose_1 + u_1)/(dose + u_1)$$
$$p_2' = 100 \cdot dose_2 /(dose + u_1)$$
$$\text{etc.}$$

By examination, we see the obvious -- p_1' is greater than p_1, and the other p's are decreased proportionately.

Since the RSAL is inversely proportional to dose (or risk), the net effect of an increase in a pathway contribution is a decrease in the RSAL proportioned inversely to the overall dose (or risk) increase.

$$RSAL' = RSAL \cdot dose/(dose + u_1)$$

EXAMPLE: Assume p_1 is 52%, p_2, p_3 and p_4 are each 16%, corresponding for simplicity to doses of 52 and 16 units respectively. Suppose now that $dose_1$ has been underestimated by 26 units, or 50%.

$$p_1' = 100 \cdot (52+26)/(100+26)$$
$$p_1' = 62\%, \text{ an increase of } 10\%$$

and

$$RSAL' = RSAL \cdot 100/126$$
$$RSAL' = RSAL \cdot 79\%$$

In this example, an underestimate of 50% in the major contributing pathway has resulted in approximately a 20% overestimate of the RSAL. An understanding of this relationship is very important to interpretation of uncertainties in the RSAL calculations.